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CLEAN VERSION OF PENDING CLAIMS

SMALL GRAIN SIZE, CONFORMAL ALUMINUM INTERCONNECTS AND METHOD FOR THEIR FORMATION
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Claims 17-52, as of February 20, 2003 (Date of Response to First Office Action).

17. (Amended) An interconnect structure in an integrated circuit, comprising:

a first layer of titanium nitride;

an aluminum film;

a second layer of titanium nitride between the first layer of titanium nitride and the aluminum film wherein the second layer of titanium nitride comprises a polycrystalline orientation that comprises a mixture of 1:1 of <111> and <200> oriented grains that are effective for forming an aluminum film of small grain size.

18. The interconnect structure of claim 17, wherein the interconnect structure is supported by a source/drain region of a metal-oxide-semiconductor transistor.

19. The interconnect structure of claim 18, further comprising a layer of titanium silicide between the source/drain region and the first layer of titanium nitride.

20. The interconnect structure of claim 17, wherein the first and second layers of titanium nitride each have a thickness of approximately 100 to 200 angstroms.

21. The interconnect structure of claim 17, wherein the first layer of titanium nitride is amorphous.

22. The interconnect structure of claim 17, wherein the second layer of titanium nitride is crystalline.

23. The interconnect structure of claim 17, wherein the second layer of titanium nitride has a mixed crystal orientation, such that a crystal orientation of an aluminum grain is selected from the group consisting of: <111> and <200>.

24. The interconnect structure of claim 17, wherein the aluminum film has a thickness of approximately 2,000 to 3,000 angstroms.

25. The interconnect structure of claim 17, wherein the aluminum film has a polycrystalline grain structure.

26. The interconnect structure of claim 17, wherein the aluminum film has a grain size of less than approximately 0.25 microns.

27. An aluminum film supported by a semiconductor substrate, wherein the aluminum film has a grain size of approximately less than 0.25 microns in diameter.

28. An aluminum film supported by a semiconductor substrate, wherein the aluminum film has a grain size of approximately less than 0.25 microns and a polycrystalline grain structure.

29. (Amended) An interconnect structure in an interconnect via defined by a bottom surface, a top surface, and sidewalls, comprising:

a first layer of titanium nitride formed on the sidewalls and the bottom surface defining the interconnect via;

a second layer of titanium nitride supported by the first layer of titanium nitride; and

an aluminum film of small grain size supported by the second layer of titanium nitride and extending throughout the interconnect via such that it is coplanar with the top surface defining the interconnect via wherein the second layer of titanium nitride comprises a mixture of 1:1 of <111> and <200> oriented grains that are effective for forming the aluminum film of small grain size.

30. The interconnect structure of claim 29, further comprising a layer of titanium silicide between the bottom surface of the interconnect via and the first layer of titanium nitride.

31. The interconnect structure of claim 29, wherein the first and second layers of titanium nitride each have a thickness of approximately 100 to 200 angstroms.

32. The interconnect structure of claim 29, wherein the first layer of titanium nitride is amorphous.

33. The interconnect structure of claim 29, wherein the second layer of titanium nitride is crystalline.

34. The interconnect structure of claim 29, wherein the second layer of titanium nitride has a mixed crystal orientation, such that a crystal orientation of an aluminum grain is selected from the group consisting of: <111> and <200>.

35. The interconnect structure of claim 29, wherein the aluminum film has a polycrystalline grain structure.

36. The interconnect structure of claim 29, wherein the aluminum film has a grain size of less than approximately 0.25 microns.

37. (Amended) An interconnect structure in an integrated circuit, comprising:

a first layer of titanium nitride;

an aluminum film;

a second layer of titanium nitride between the first layer of titanium nitride and the aluminum film wherein the aluminum film has a small grain size wherein the second layer of titanium nitride comprises a polycrystalline orientation that comprises a mixture of 1:1 of <111> and <200> oriented grains that are effective for forming an aluminum film of small grain size.

38. (Amended) An interconnect structure in an interconnect via defined by a bottom surface, a top surface, and sidewalls, comprising:

a first layer of titanium nitride formed on the sidewalls and the bottom surface defining the interconnect via;

a second layer of titanium nitride supported by the first layer of titanium nitride; and

an aluminum film having a small grain size, supported by the second layer of titanim nitride and extending throughout the interconnect via such that it is coplanar with the top surface defining the interconnect via wherein the second layer of titanium nitride comprises a polycrystalline orientation that comprises a mixture of 1:1 of <111> and <200> oriented grains that are effective for forming the aluminum film of small grain size.

39. (Amended) A transistor with an interconnect via, defined by a surface substantially free of voids, comprising:

an interconnect of silicon oxide or borophososilicate glass that defines a semiconductor structure that defines an inteconnect via comprising an active region of a transistor;

a titanium nitride film on the semiconductor structure;

a second titanium nitride film having a polycrystalline orientation that overlays the titanium nitride film; and

an interconnect overlaying the second titanium nitride film, the interconnect comprising aluminum of small grain size, wherein the second layer of titanium nitride comprises a polycrystalline orientation that comprises a mixture of 1:1 of <111> and <200> oriented grains that are effective for forming the aluminum of small grain size.

40. The transistor of claim 39 wherein the via has a high aspect ratio.

41. The transistor of claim 40 wherein the aspect ratio is greater than about 5:1.

42. The transistor of claim 40 wherein the aspect ratio is about 8:1.

43. The transistor of claim 40 wherein the thickness of the second titanium nitride film is about 100 to 200 angstroms for a 0.25 micron interconnect via.

44. The transistor of claim 40 wherein the thickness of the aluminum interconnect is about 2000 to 3000 angstroms.

45. (Amended) An integrated circuit with an interconnect structure, the integrated circuit comprising:

a first layer of titanium nitride;

an aluminum film of small grain size;

a second layer of titanium nitride between the first layer of titanium nitride and the aluminum film, wherein the second layer of titanium nitride comprises a polycrystalline orientation that comprises a mixture of 1:1 of <111> and <200> oriented grains that are effective for forming the aluminum film [has] of a small grain size.

46. The integrated circuit of claim 45 wherein the first and second layers of titanium nitride each have a thickness of about 100 to 200 angstroms.

47. The integrated circuit of claim 45, wherein the first layer of titanium nitride is amorphous.

48. The integrated circuit of claim 45, wherein the second layer of titanium nitride is polycrystalline.

49. The integrated circuit of claim 45, wherein the second layer of titanium nitride has a mixed crystalline orientation, such that a crystal orientation of an aluminum grain is selected from the group consisting of: <111> and <200>.

50. The integrated circuit of claim 45 wherein the aluminum film has a thickness of about 2000 to 3000 angstroms.

51. The integrated circuit of claim 45 wherein the aluminum film has a polycrystalline grain structure.

52. The integrated circuit of claim 45, wherein the aluminum film has a grain size of less than about 0.25 microns.